Phosphorus Fate, Transport, and Treatment from Individual Treatment Systems - Current State of Knowledge and Issues Facing Idaho

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HDR

Defining the Problem

- Permitting of Individual Treatment Systems (ITS) has focused on protecting surface and groundwater from pathogens and nitrates.
- ITS have been identified as a nonpoint source contributor of P to some water bodies.
- Trend toward centralize treatment, but not feasible in many areas in Idaho.
- Need for guidance for siting and permitting ITS where P is a surface water concern.
- Need for approved treatment technologies for P removal from ITS

Defining the Problem

- On-site wastewater treatment systems
- Large soil adsorption systems (>2500 gpd)
- Central Septic Systems (>2500 gpd)

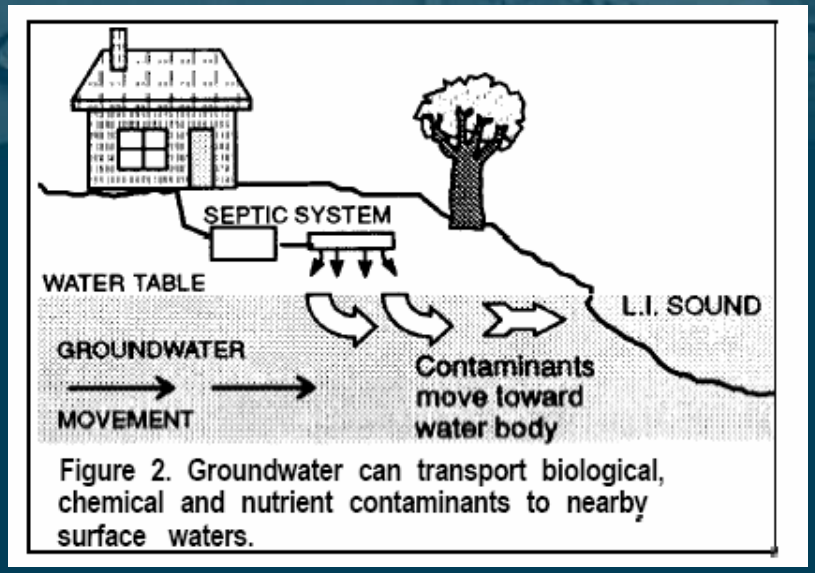


Figure 2. Groundwater can transport biological, chemical and nutrient contaminants to nearby surface waters.

Defining the Problem

- Today:
  - Fate and transport of P from ITS
  - Highlight studies on P from ITS
  - Treatment technologies
  - Recommendations

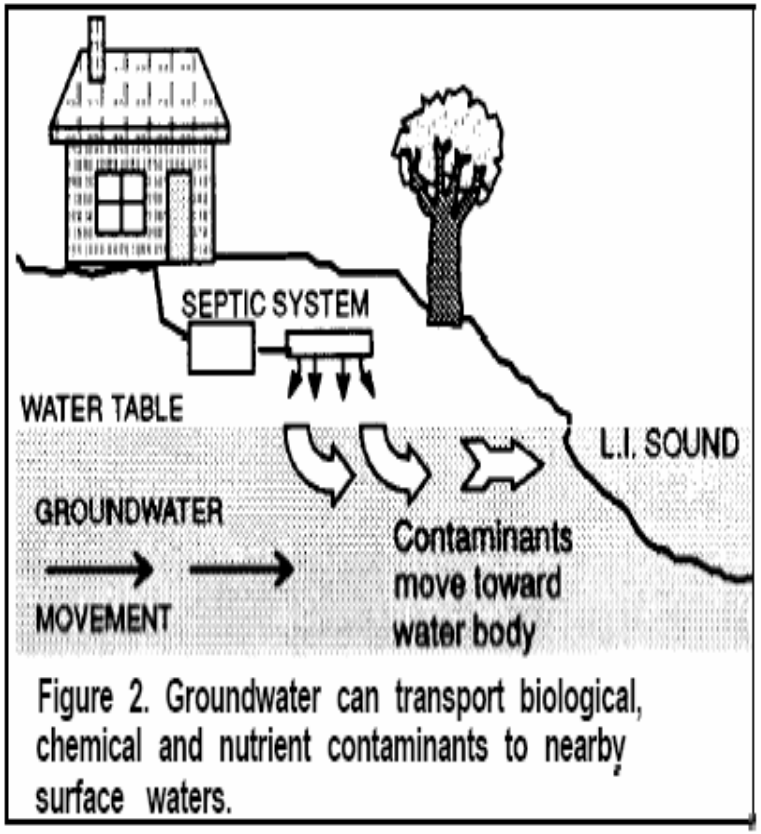
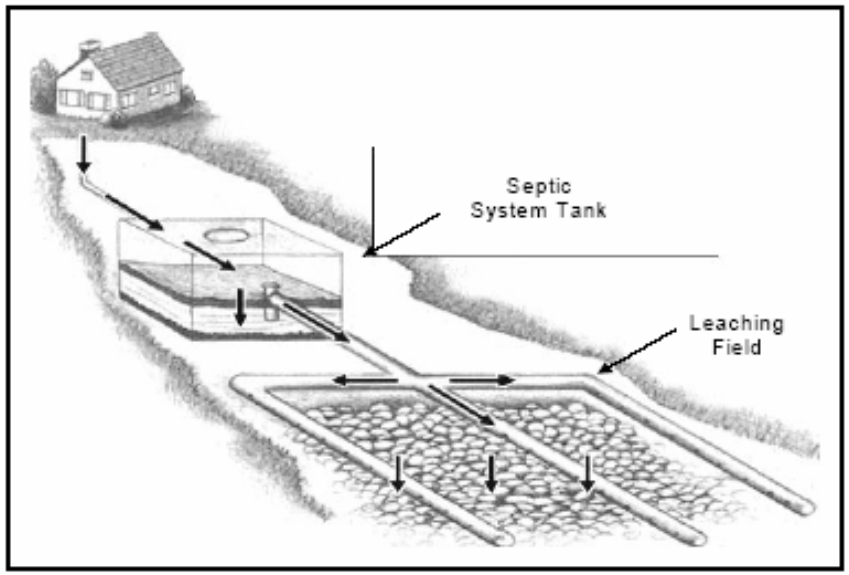


Figure 2. Groundwater can transport biological, chemical and nutrient contaminants to nearby surface waters.

Fate and Transport

Phosphorus in the Septic Tank:

- Derived from organic molecules, laundry and dishwashing detergents.
- Approximately 76% of the P as orthophosphate ion PO_4^{3-}
- Septic tank effluent P ranges from 7 to 15 mg/l.



Source: U.S. EPA, 1991.

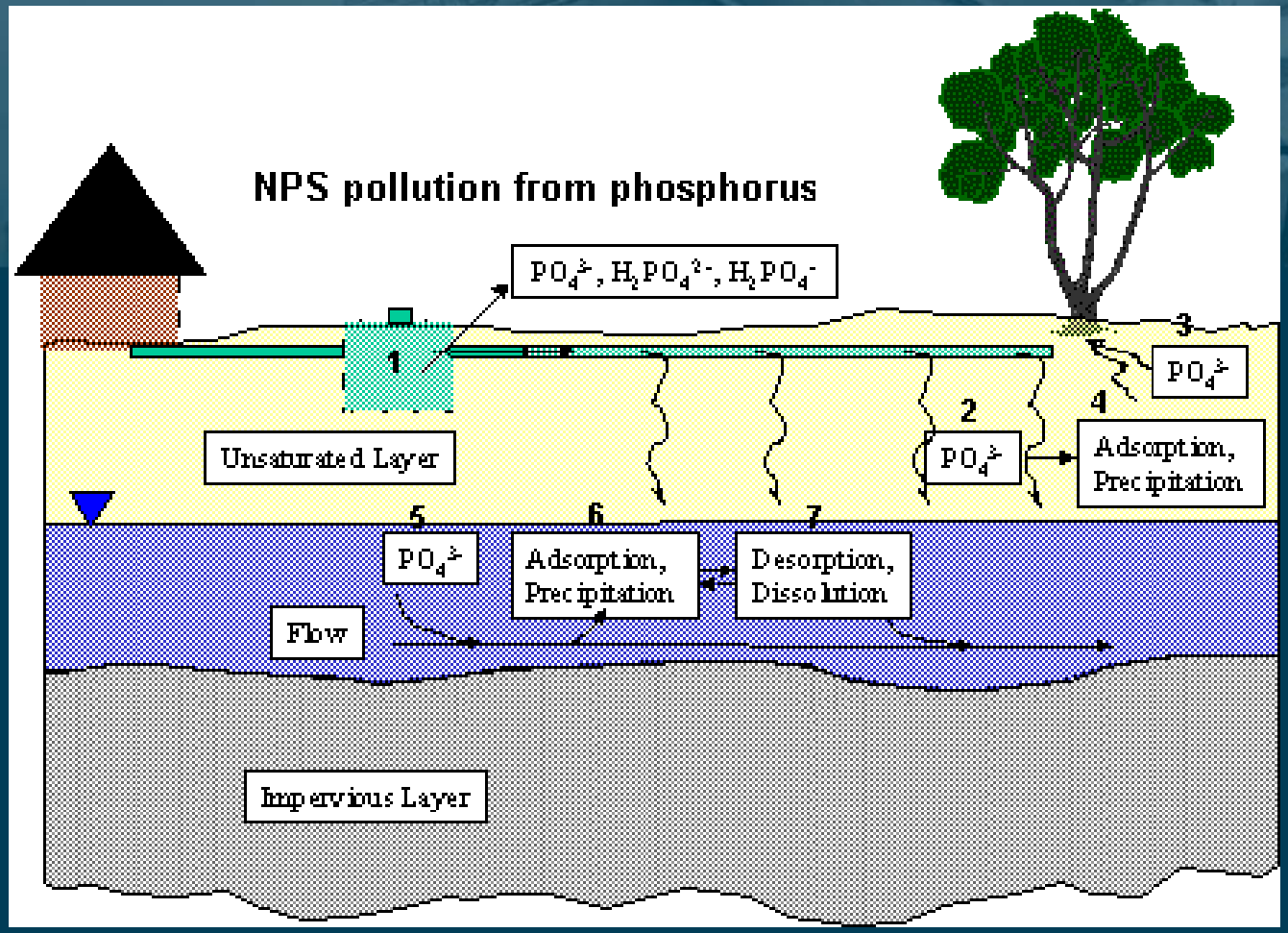
FIGURE 1 SEPTIC SYSTEM TANK

P in laundry detergents were banned years ago, but dishwasher detergents were not included because P-free alternatives were limited

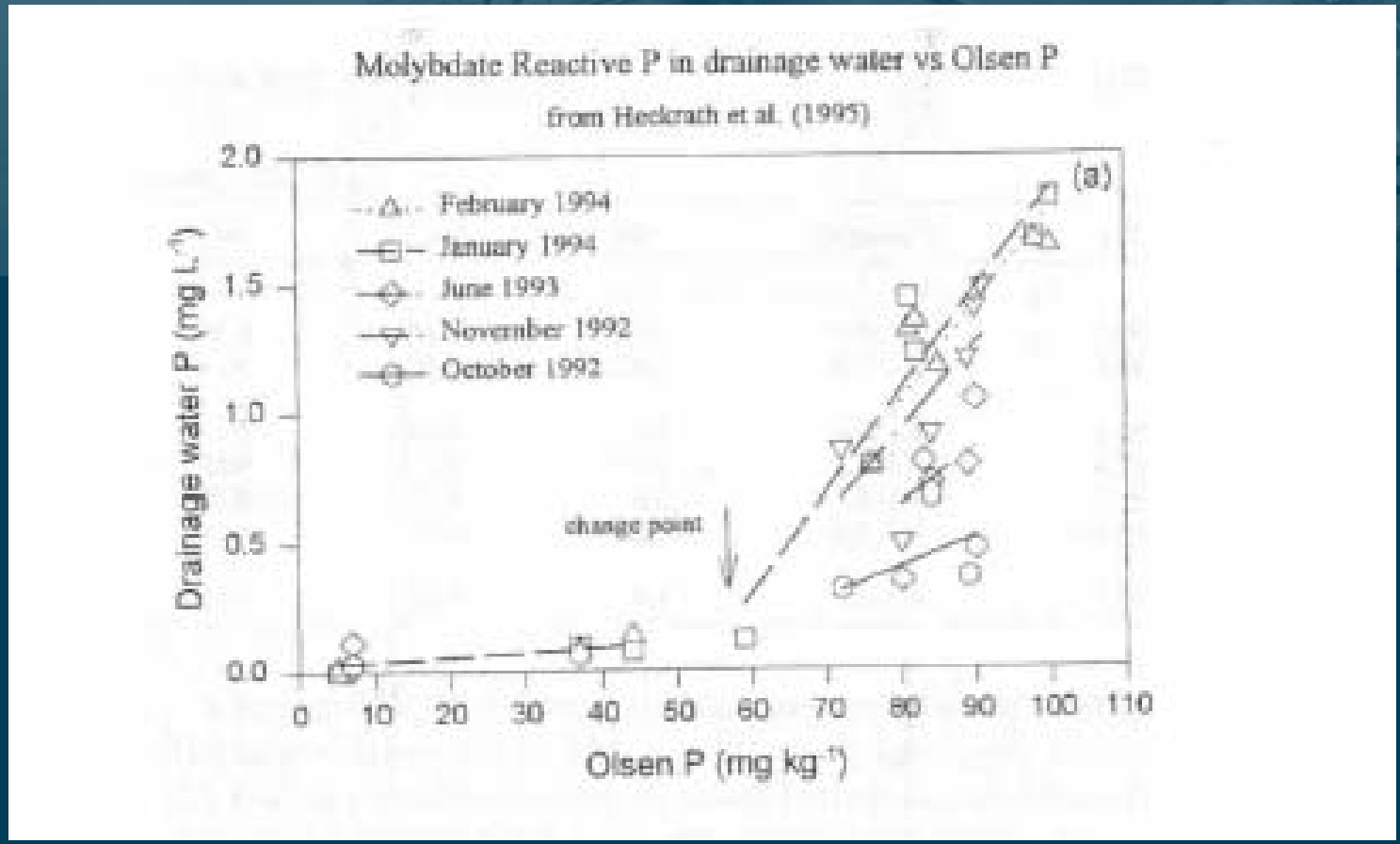
- Examples of P in different dishwasher brands:
  - Zero (e.g. Seventh Generation)
  - Low (e.g. Palmolive gel 1.6%)
  - Medium (e.g. Electrosol Powder 4.5%)
  - High (e.g. Electrosol tablets 8.7%)

Source: Missoula Valley Water Quality District

Fate and Transport



Continued P Loadings Result in Increase P in Soil Solution



Studies of P from ITS

- 3.5 to 7.3% total P budget of Otsego Lake, New York (Meehan, H. 2003).
- Measured P in groundwater beneath drainfield 667 to 22,070 ug/L.
- Cascade Reservoir, 6% of the P loading (2,205 kg/yr based on 1795 systems).
- Red Cedar Lakes, WI, 2% of the P loading

P Removal

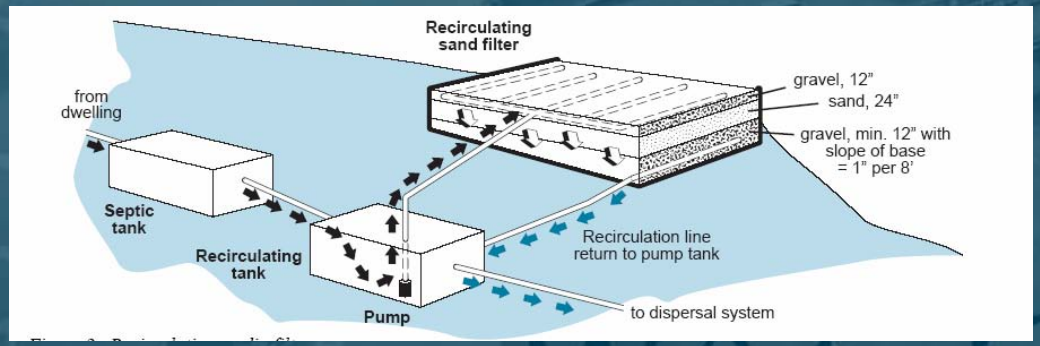
Centralized systems

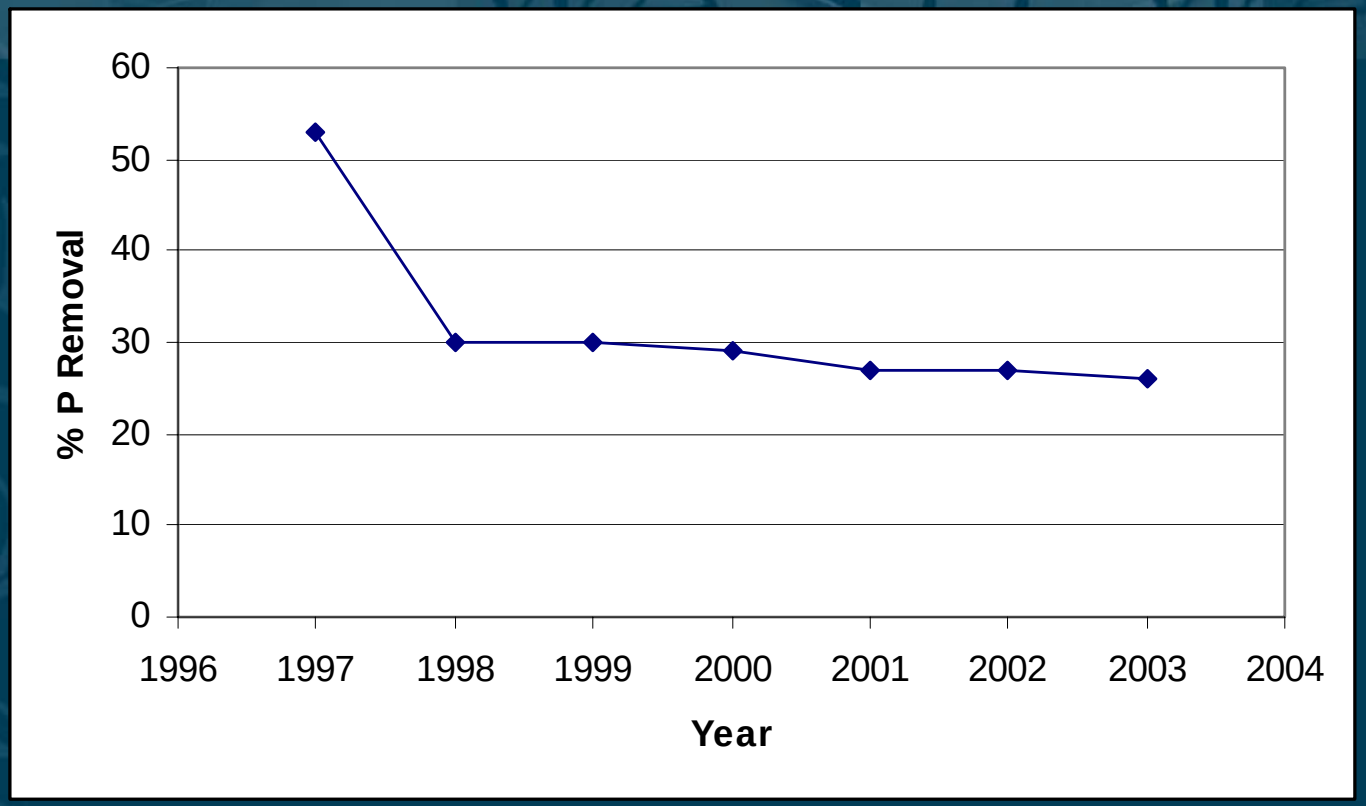
- Enhanced Biological Phosphorus Removal (EBPR) – Cycling of biomass through anaerobic and aerobic zones. Controlling process difficult
- Chemical Precipitation – cost of chemicals, expertise, solids.

P Removal

- Decentralized systems
  - There has been very little development in technology for P removal.
    - Not been required by regulators
    - No commercial incentive
    - Currently no approved systems in Idaho for ITS designed specially for P removal

Recirculating Sand Filter System

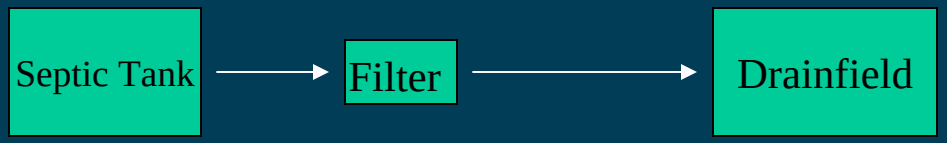


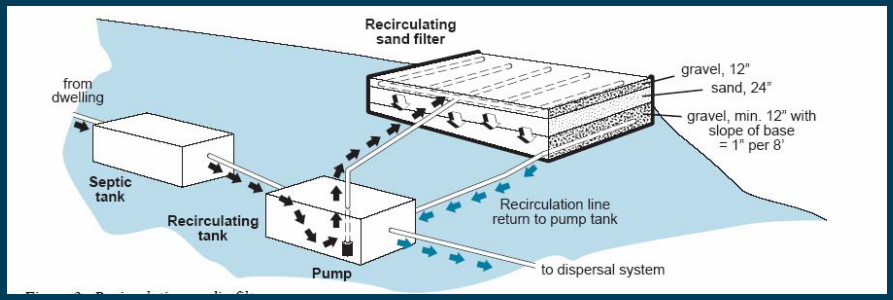


SR9021 - Phosphorous Removal from Septic Wastewater

Chris Kinsley and Anna Crolla, Alfred College

- Four adsorptive materials were tested calcite, shale, limestone and slag.
- A filter for a four person household with a design life of ten years would require a slag filter of 3.2 m3 or 5.2 tonnes.





Storm Vault → Filter → Discharge


PERLITE


CSF® LEAF MEDIA


ZEOLITE


IRON INFUSED


GAC


PLEATED FABRIC

MEDIA SELECTION GUIDE

POLLUTANT	PERLITE	CSF	ZEOLITE	GAC	IRON INFUSED	PLEATED FABRIC
Sediments	✓	✓				✓
Oil and Grease	✓	✓				
Soluble Metals		✓	✓		✓	
Organics		✓		✓		
Total Phosphorus	✓				✓	✓
Dissolved Phosphorus					✓	
Total Nitrogen	✓	✓	✓			✓
Dissolved Ammonium			✓			

Stormwater management Inc

Summary and Conclusions

- Increasing P Focus for Protection of Surface Water
- Thinking about P is changing
- ITS identified as contributor (generally been system failures)
- Need for guidance on P evaluation for ITS
- Need for approved alternative systems for P removal

Recommendations

- Source Reduction
- Opportunities for demonstration projects:
  - guidelines
  - alternative system evaluations
- Involve stakeholders
  - Homeowner Associations, developers, local governments